Internet of Food Things Network Plus: event report series

IoFT Launch Event
21 September 2018
IET Global Engineering Hub, London

IoFT Operations Team
University of Lincoln

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The network

"The problems are real and the opportunities are now."

Professor Simon Pearson, University of Lincoln and Network lead

The Internet of Food Things Network Plus (IoFT+) launched at the IET Global Engineering Hub in London on 21 September 2018 with a gathering of experts from industry, government and academia.

In a series of keynote talks and discussions they opened a three-year investigation into how artificial intelligence, data analytics and emerging digital technologies can improve the safety, security and efficiency of the UK food supply chain.

The meeting introduced the network's leadership team:

- Professor Simon Pearson, University of Lincoln (network lead)
- Professor Jeremy Frey, University of Southampton
- Professor Roger Maull, University of Surrey
- Professor Gerard Parr, University of East Anglia
- Professor Andrea Zisman, The Open University
- Professor Luc Bidaut, University of Lincoln

who were keen to hear insights, information and ideas for the activities of the network from all those present, as it will be very much led by its members. The launch event's talks were designed to stimulate, inspire and to encourage discussion, which was continued in breakout sessions as well as in the extensive networking time.

This report sets out the context, opportunities, technologies and priorities that emerged from that meeting and which will inform the direction of the three-year IoFT+ programme.

The context

The launch of IoFT+ could not be more timely. From Brexit to cybersecurity threats, the modern food manufacturing supply chain is profoundly vulnerable in terms of the complexity, demand and uncertainty surrounding processes, sources and dependencies.

Nor has the industry ever been more critical to the wealth of the nation. Food manufacturing is the UK's biggest manufacturing sector. With a value of £108bn it is larger than the aerospace and motor industries combined, providing 3.9 million jobs in 600,000 food businesses. It is also a truly international industry with £20bn of exports in 2016 (along with imports from 184 countries around the world). Between 2006 and 2015, the UK food chain grew GVA by 30%, exports by 72%, branded food exports by 100% and food chain employment by 5% (Defra, 2017).

Interest in food is at unprecedented levels, not least among 18-34s – the so-called 'millennial generation' (see Appendix 1: top 10 trends).

However, the food industry's impact on society is not wholly positive.

Environment

Food manufacture and distribution consumes 15% of global fossil fuels and accounts for 28% of global greenhouse emissions. The sector suffers from alarming amounts of waste, with more than 10 million tonnes of UK food thrown in the bin every year. While the majority of that waste is produced by households, 1.7 million tonnes of food waste is from the manufacturing sector and 0.25 million tonnes from the grocery, retail and wholesale sector. Food waste costs the UK £17bn each year.

Health and wellbeing

There are more than a million cases of food poisoning a year in the UK while obesity costs the NHS £47bn a year. Between 2016 and 2017 the Food Standards Agency (FSA) investigated 2,265 food, feed and environmental contamination incidents.

Crime

Food crime is an ongoing and increasing threat in the UK. The National Food Crime Unit (NFCU) was set up in 2016, following the horsemeat scandal. Since then it has received and analysed information resulting in the dissemination of over 1,800 tactical intelligence reports to enforcement partners. Highlights include the removal of over one third of a million lethal doses of 2,4 dinitrophenol from circulation.

The opportunity

"I see this as an incredible opportunity. The opportunity for IoFT+ impact is vast and comes at a time of huge horizontal and vertical changes to the food supply chain."

Guy Poppy, chief scientific advisor at the Food Standards Agency

Digital technology has the potential to transform the food chain. The Made Smarter review, an independent review of industrial digitalisation led by Professor Juergen Maier (CEO Siemens UK) identifies a £55.8bn opportunity for the food and drink sector over the next 10 years through the adoption of currently known digital technologies.

According to the report:
"Automation could increase productivity growth in food processing and wholesaling from 1.4% to 3% per annum. That would increase food chain GVA by 8.3% above the underlying trend by 2022. Furthermore, it could reduce greenhouse gas emissions by an estimated 29% throughout the food supply chain by 2027 due to efficiencies from digitally managed processes in manufacturing and distribution. There would also be a corresponding reduction in waste management and food waste of 17.6 million tonnes over the next decade, factoring in greater visibility of shelf life." (Made Smarter, 2017)

Within the food processing industry, the report notes, digital technology provides a significant opportunity to:

- Improve production efficiency (eg through robotics, automation, and connectivity)
- Improve traceability by connecting the whole supply chain (eg through IoT, distributed ledger technology, cloud data architectures and data analytics)
- Create more efficient and rapid supply chains (eg through intelligent just-in-time delivery, IoT monitoring and highly connected planning software)
- Improve feedback from retailers, consumers and food services (eg through automatic supply and demand forecasting systems)
- Improve consumer trend monitoring to assist in the development of new products (eg through point of sale data analytics and social media analytics)

The Holmes report (December 2017) highlighted food as one of seven key industry sectors most likely to benefit from distributed ledger technology. Focusing on collaboration, coordination and commitment, it has produced 23 working groups – of which three focus on food – with participants from more than 200 organisations.

The technologies

"Food is at the front of the pack in terms of the work that's taking place."

Patrick Curry, CEO of the British Business Federation Authority

The keynote speakers at the launch event offered some use cases of how digital technology is already addressing these opportunities – and its potential to drive Industry 4.0.

Smart sensors: food safety

Checkit is a Cambridge-based company that has developed a real-time operations management platform to digitise food safety management processes. A three month trial saw five businesses in the Cambridge area replace their paper-based food safety management processes with Checkit's digital solution. Data was exchanged between food businesses, local authorities and the FSA. Daily compliance checks were recorded via wireless sensors and the results automatically uploaded to the cloud for storage (digitally time stamped and tamper-proof). Through the cloud-based control centre, users can access records remotely, receive alerts on any anomalies and track performance in real time. It

enhances trust in the system, increases the efficiency of food safety inspections and helps inform the decision-making approach for auditors and inspectors, who can concentrate their efforts on high risk businesses.

Data sharing: allergy alerts

Early in 2018 the FSA made available a new data service to provide a live data stream of food products withdrawn or recalled. This service powers the alerts on the FSA website (dogfooding) as well as being available for third parties to use. The result is that anyone wishing to publish the alerts on their own website can access this data and automate the updates. This is to help ensure that those who need to know about food alerts have a means of doing so in a timely and efficient way. Data has no value until it is actioned and used in some way. With more people admitted to hospital because of allergies and intolerance than food poisoning, this is a real attempt to get the data rapidly to the people to whom it matters.

Distributed ledger technology: abattoir compliance

The FSA is leading the way within government in real world applications of distributed ledger technology (DLT). The agency has successfully completed a pilot using DLT in a cattle slaughterhouse – the first time DLT has been used as a regulatory tool to ensure compliance in the food sector. In the pilot both the FSA and the slaughterhouse had permission to access data, giving the benefit of improved transparency across the food supply chain. The FSA is keen to emphasise that DLT is not a magic bullet and inspectors are still needed to monitor integrity and authenticity. However, it can remove laborious tasks and add value to collected data, which would otherwise be a wasted resource, and map conditions which, when fed back to farmers, can influence management practices and improve quality.

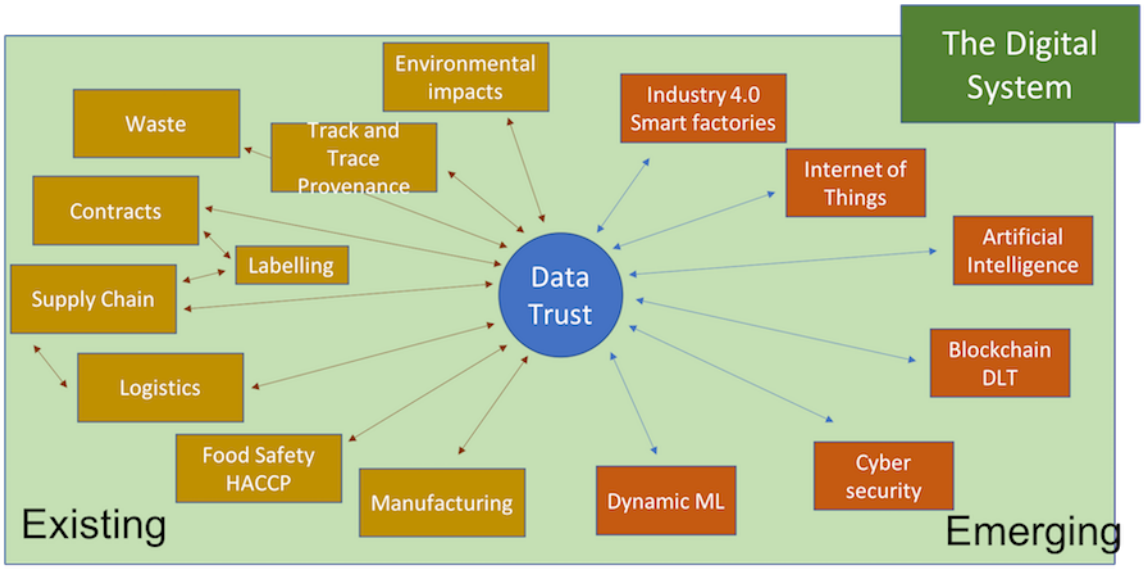
Distributed ledger technology: risk reduction

Kirsten Coppoolse, COO of The Fork, highlights how DLT can contribute to agrifood by reducing risk. When a product is tracked from farm to fork it becomes easier to prevent foodborne diseases. For example, smart sensors and DLT can be used to monitor the temperature of a product during its journey, ensuring product temperatures don't exceed pre-set limits required to keep the product safe for consumption. ZetoChain does this by fixing special labels to food products. ClearKarma collects data on ingredients and production processes and stores these with DLT, preventing undeclared allergens from ending up in food. DLT can also assist with fast and effective recalls when something goes wrong with a product and is used by Walmart in this way.

The challenge

"Culture, not technology, is stopping things – we need to change the culture."

Keith Thornhill, head of food and beverage, Siemens UK and Ireland



Key elements of the digitalised food manufacturing supply chain

For the opportunities offered by digital technology to be realised in the food chain, the challenge is to join together all those elements in a data trust model, underpinning standards, governance, data sharing, interoperability and cyber security. With that connectivity there will be added value and the benefits will flow:

- Increased productivity
- Reduced waste
- Greater choice
- Support for the environment

As part of this defragmentation, there is an urgent need to connect the digitally focused academic community with the food industry.

IoFT+ is bringing together three perspectives – academic, industrial and policy – to meet that challenge through reports, papers, events and seven pilot studies worth £50,000 each.

The priorities

Areas of interest and potential themes for the network include:

- Whole supply chain risk profiles
    - Wide scale application of the IoT for service community
- Emerging technologies

    - Digital manufacturing of food
    - Use of novel digital technologies to reduce food waste
- New business models
    - DLT to underpin traceability
- Barriers to implementation
- Standards, structure, governance and trust
    - Creation of data trust for the food sector
- International collaboration
- Communication and defragmentation
- Public engagement
    - Schools engagement with activities and competitions around this area.

At the launch meeting participants divided into small groups to discuss the priorities. Each group was led by a member of the leadership team in order for them to gain greater insight into what attendees felt were the most pressing issues and opportunities.

Some of the areas and questions that arose were:

- Using machine learning for establishing governance
- Opportunities around the use of sensors and IoT at the farm level to understand better how soil responds to interventions such as fertilisers
- Waste and packaging
- Connectedness as an issue across entire ecosystem and the need for an agreed reference architecture for supply chain
- Document digitisation and management (and the possibility of learning from NHS colleagues)
- Interoperability – emergence of data quality standards, plus data flow into academia and ethics
- How do we educate the consumer to give them more confidence in what they are consuming? Can everyone read smart labels?
- Ethical consumers and their influence, including the next generation in primary schools
- Alerts – how do they go out and what impact do they have?
- Scale – many of the interventions are about big farmers and supermarkets but what about the small farmers and retailers? Who reduces the pain for them?
- How do we connect the digital and the physical? How do we ensure that the physical that relates to the digital is not tampered with?

Suggestions for working groups included: sensors and sensor networks; the role of inclusivity, public understanding and acceptability, especially when introducing AI and IoT

Conclusions and next steps

An exciting three years lies ahead for the network. Alongside funding opportunities for smaller projects and white papers, there will be two major calls over the lifetime of the

network. These will be tied to workshops and bids should be led by academics with a business partnership. The first call is likely to be in January 2019.

Meanwhile, all those interested in the work of the network are urged to become members by joining the Foodchain mailing list. To do this, send an email to listserv@jiscmail.ac.uk

Subject: Subscribe
Message: SUBSCRIBE FOODCHAIN Firstname Lastname

You will then receive a confirmation email. We will send out news and updates relevant to our themes and periodic updates relating to the opportunities offered by the network.

You can also follow us on Twitter: twitter.com/IoFTnetworkplus.

APPENDIX 1

Millennials and food: the top 10 trends

1. Food is the new rock'n'roll for generation sensible
   While 67% of 18-34s would prefer to stay in than go out, they do leave the house to eat out. Food is the number one way millennials socialise with their friends.

2. Food tribes are replacing music tribes
   From craft beer nerds to clean eaters, vegans to protein gym bros, millennials identify themselves and each other by what they eat.

3. Veganism is blossoming
   Half a million people in the UK are vegan and 42% of those are young people. It's now a mainstream lifestyle choice.

4. Reformulation is the new innovation
   Millennials are not scared by technology and they embrace innovation in food, from broccoli coffee to Beyond Meat 'bleeding' burgers.

5. Origins are important
   More than half would pay more for ethically sourced products and buy organic products. But ethics are still trumped by price and quality.

6. Beyond Instagram
   When 69% of millennials take pictures of their food before eating they are now looking for uniqueness – and unicorns. Think unicorn drinks, unicorn toast, edible cookie dough and charcoal ice cream.

7. Food is making young people famous
   Deliciously Ella kicked off the trend, now Elijah Quashie, the chicken connoisseur, is the one to watch with The Pengest Munch.

8. Healthy eating might not be
   Eating disorder charities claim that the obsession with 'clean eating' is tipping over into unhealthy habits.

9. Journeys with food
   Young people want to explore countries, cultures and cuisines with 80% saying they like to try new foods.

10. Convenience is king
    Everything is just a click away so high-quality food has become more accessible. Want Korean food in the park? Click Deliveroo.

Presented by Josephine Hansom from Youthsite at the IoFT+ launch